Limestone and Phosphate

Experiences of Illinois Farmers as Told Before the 24th Annual Meeting of the Illinois Farmers' Institute, Joliet, February 19, 20, 21, 1919.

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LIMESTONE AND PHOSPHORUS FUNDAMENTAL.

(Frank I. Mann.)

As a farmer I am producing food. As a farmer I want to know what food is; if I am going to produce food I want to know what it does, what its functions are. When I am prepared to know what it is I am going to produce, I am a manufacturer. I am manufacturing raw materials into finished products. I am converting some of the simple elements in the ground into food crops. I am converting those crops into higher finished products, into animals. In either case I am manufacturing, just as a man who puts wood and iron together and makes a binder of it, only I use other power. He stokes a boiler, perhaps, for his power. I don't stoke a boiler for my power. I go to the original source of all heat and power on this earth. I use the sunlight as my power, and there is a magic in the sun rays that has never been imitated. No chemist has ever made what the sunlight will make in the leaf, no stoking power of any kind will do that. That is a laboratory. We won't call it a factory, we will call it a laboratory where we do those things.

As manufacturers of food, we farmers are growing crops. That is all we are doing; we are manufacturing food, because the crops are food. The only thing of value in our crops is food. We call it feed if we feed it to animals, but ultimately it reaches the human stomach as food. Now, whether it is feeds or foods, everything that makes either feeds or foods can be thrown into one or more of three classes of materials. In one class are those things which form the bone or framework of the animal, whether it is a human or a lower animal; in another class are the materials that put the machinery on the bones, that hold the bones together, supplies the muscles and the tissue and the nerves, and all those things in the machinery. There are some pretty delicate nerves there, too. It takes one class of materials to make that part of the body. Then we put a little fuel into that body and we give those bones and the muscles a little energy, and that is the third class of materials.

Bones are four parts of limestone, common everyday limestone that we use for building purposes and for road purposes, and one part phosphorus. Of course, there must be some marrow and other things, but the essential thing is the lime and the phosphorus. The tissues are the nitrogeneous part. Nitrogen plays just the same important function in those things which form tissues as it does in the manufacture of gunpowder, nitroglycerine, trinitrotoluol, and all the explosives that are used in war. Nitrogen is the measure of their production, and on many soils in Illinois today nitrogen is the measure of the production of crops. Proteins, we will call them for convenience.

What are proteins? Proteins are made up of about eighteen or twenty different kinds of material, but they all have a nitrogeneous base, nitrogen is the main thing in them. Some of you are buying tankage for the nitrogren and the protein in it? Protein is wonderfully complex. Feeding it to plants is mighty simple to that of feeding it to animals. We talk about various things nowadays, and when we are going to feed animals we have to know how to use these eighteen different kinds of substances which form protein. When we feed crops it isn't that way at all. Alfalfa knows enough to make eighteen kinds of substances, and it takes care of itself, but the animals do not.

Then the energy is the fuel. That is the carbo-hydrate materials which the leaves get out of the air exclusively, combined with the component parts of water. The source of the materials which form bones, the limestone and the phosphorus, is no other than the soil.

For nitrogren, there is another source. Nitrogen is in the air, four-fifths of it. We have a class of plants which gets it from the air, and we have a class of plants which must have it in the soil. We have the legumes which take it from air, but the corn, oats, barley, wheat and rye must take it from the soil. Then we can easily see that we can gather the nitrogen from the air in those plants and put it in the soil for the sake of the plants which must take nitrogen from the soil.

Limestone and Phosphate Fundamental.

Plants can gather nitrogen from the air in proportion as they can secure the bone forming materials in the soil. Clover, alfalfa and those plants which gather nitrogen will grow in accordance with their supply of limestone and phosphate. The cinders thrown out by the smokestack give an application of lime and phosphate along the right of way, and the clovers grow along the right of way anywhere where the locomotives have been going for a long enough time.

I was talking with a man from Burlington, Iowa, day before yesterday, Mr. Moyer. I met the people over in that part of the state, this side of Burlington, along the river there on some of the blow sand, and asked some of them three or four years ago what that land was worth. They said it was worth nothing. "What can you buy it for?" "Oh, $5 or $10 an acre." Mr. Moyer went over and bought a large area of it. He is now growing from $75 to $100 worth of alfalfa each year on it. This blow sand you will have today and tomorrow someone else will have it, if you don't save it. Now he can grow anything there.

Alfalfa and clover will gather nitrogen in proportion to the limestone and phosphate that they can secure from the soil. On most of my farm I still grow clover, but I had one hundred acres that would not grow clover. It has a sandy subsoil and too poor to grow large crops for many years. We pastured it, then plowed it for a year or two, then pastured it again. It was always too poor for steady cropping. We put on five tons of limestone to the acre and we got two and a half tons of alfalfa. We put on a ton and a half of phosphate and secured 4 tons of alfalfa. We put on 4 tons of phosphate and grew 6½ tons of alfalfa, alfalfa being measured by the amount of phosphorus that we put on the land, in connection with the limestone.

Phosphate alone would not do it. Limestone alone would not do it. Limestone and phosphate together did do it. It is like starting a car. You go out and crank your tin lizzie and if anything is wrong it won't go. If your carburetor is wrong, if your spark is wrong, if your generator is wrong, if any of those things are off, it won't go. You have to get them all just right. It is the whole combination that works together.

What does it mean to grow six tons and a half of alfalfa? It means that the first two and a half tons cost $10 a ton to grow; it means the difference between two and a half and six and a half tons of alfalfa was grown for 50 cents a ton. What does that mean? It means that if the dairyman was on to his job growing milk, feeding six and a half tons of alfalfa to make milk he could sell milk at half the price at which he sells it today and make more money than he is now making. He would be rendering some service to society, wouldn't he? What is it that he doesn't know? That is what this Institute is for. The time will come when he will have to do it or get off the job.

I have one little patch of ground near my house where we took off three feet of surface soil and had left soil the color of this floor. There was a lot of limestone in it, and for two years sweet clover, alfalfa, alsike and mammoth clover were growing in that pit, and now the best blue grass is coming. We can get nitrogren in proportion as we feed the lime and phosphate.

There is that much in food production. This carbon that we get out of the air to make the sugars and the starches was taken by the leaves of the plant from the air. We don't have to replace it. Every fire that is built replaces carbon in the air, and there is practically a fixed quantity, always an abundance of it, enough to make two hundred and fifty bushels of corn to the acre. So we don't need to worry about carbon as a raw material, except how to get more of it.

When we travel through this state, through the richer part, you see leaf surface enough on plants to get four times the amount of corn farmers are getting. In many cases you say they don't understand how to get that carbon. We haven't discussed that very much. Even in our work here in Illinois we haven't discussed the practicabilities, or the possibilities of methods or manners of getting carbon from the air.

Say we have a corn plant, a good, big corn plant, which produces no ear. Say we also have one here that produced a pound ear. They are the same size plants. Take the ear off of that stalk which produced an ear and there is just as much nutriment left, just as much valuable materials left in the stalk as there was in this plant that bore no ear. That plant was not only growing and making the stalk, but it was also making a pound ear, while this other plant has nothing but the stalk. Is the grain worth anything? Then we ought to know why this one did not make an ear.

Are the carbo-hydrates worth anything? When I plant an acre of corn I don't get any plants that don't bear corn, every plant has an ear of corn. Some people think that barrenness is due to inheritance, but it really tends to run itself out. Suppose I start with the field one-half barren and the other half productive, the next cross will be one-fourth barren and three-fourths productive, and so on, then in forty or fifty generations you have not eliminated the barrenness wholly under the laws of breeding, but you have reduced it. So you see it cannot all be due to heredity. It must be a matter of nutrition. Why? Remember something about the habits of plants and their growth. The corn plant grows, gathering food—and so do all other grain plants—gathering food from both the soil and the air to make its stalk first. Then when it has its size, when the time of the year comes for it to stop growing, it stops growing and ceases to take food from the soil, but continues to take it from the air. That is when the ear is made, after the plant has stopped growing and reached its size, and most of the grain is made from the material the leaves take out of the air, but the nucleus, the protoplastic nuclei of the grain must be started from the material that is taken from the soil.

If this barren plant had been able to start some grain; if it had enough materials that it took from the soil to start the ear, then it would have had a place to store the starches and its leaves would be busy getting carbon, while if no grain starts they remain idle. When I give an acre of corn only three pounds more phosphorus I can start enough more grain to be able to store enough more starches to make about fifteen bushels more of corn.

You see that limestone and phosphorus is a measure of our ability to get nitrogren from the air; and that limestone, phosphorus and nitrogren is the measure of our ability to get carbon from the air. Then I have made provision for everything in plants of value, the bone forming materials, the tissue forming materials, the bone forming materials, and the energy forming materials.

What is the fundamental thing that is necessary? Limestone and phosphorus. Common everyday limestone. I think you will pretty well agree that limestone and phosphate are the basis of our agricultural production.

The only things we have to buy and put on our land is limestone and phosphorus, and we will never have to buy anything else. Some abnormal soils may need other things, but we never have to buy anything else on normal soil than limestone and phosphorus.

MORE LIME MORE CROPS.

(H. G. Easterly.)

My farm consists of 240 acres of timber land, 200 acres under cultivation. Analysis showed this soil to be deficient in lime, about 2,300 pounds to the acre in the first six inches of the soil.

Under date of August 4, 1904, Dr. Hopkins wrote me as follows: "The acidity in the sub-soil is very much greater than in the surface and it is very probable that your soil will not grow clover successfully except in a very wet season. The analysis of your soil certainly emphasizes the importance of liberal applications of lime and liberal use of clover or other leguminous crops as catch crops in rotation crops which do not grow well in acid soil." I immediately went to Chester and bought two carloads of lime dust. It was ground very coarse, like meal, and put up in cement sacks,—80 pounds to the sack.

This lime dust cost me 80 cents per ton at the station, the sacks to be returned when empty. It was hauled and stored in a shed. Fifty acres were broken for wheat and this dust was emptied into wagons and spread by hand with shovels. The 80 tons covered the 50 acres. This field was sown in wheat in the fall and to clover in the spring. This being a dry year, the clover didn't do much. Two years went by before I got up courage to buy lime dust again. Then I broke eight acres of pasture land in early spring, cultivated, disked and harrowed it several times during the summer, and put on five tons of lime dust to the acre. By this time we had bought a spreader. The field was seeded to alfalfa August 10th, and a fine stand secured. We hauled several loads of dirt and put on this ground, getting it from the railroad right of way, where there was plenty of sweet clover. We harvested on an average of about 3½ tons per acre for three successive years. The fourth year we took off the first crop, and being a dry year we were forced to pasture it.

Seeing how profitable alfalfa was we prepared and limed 30 acres, sowed about September 1st, using five tons of lime dust to the acre. As the winter came on early, this did not get as good a growth as before and some of it heaved out. We cut it two years, then planted 15 acres in corn. The corn made 55 bushels per acre. When we laid by our corn the last time, at the last cultivation, we sowed about one bushel of cow peas to the acre. Part of this corn was put in the silo, and part of it was gathered. The next year this field was sown to cow peas. The peas made 2 tons of hay to the acre and 6 bushels of peas. The hay sold for $27.00 per ton, and the peas for $3.50 per bushel. The land was disked and sowed to wheat. We expected to put on 5 tons of lime again. That was in 1917, and it was impossible to get cars and we did not sow any kind of clover. The wheat made 30 bushels per acre and was sold for seed at $3.00 per bushel. This past fall it was sown to wheat again.

We have also been using rock phosphate, along with our lime dust, and this past fall we put on 1,500 pounds of phosphate per acre, then broke the ground, and put on 5 tons of lime dust, and sowed to wheat. I want to say that we have almost gotten round to using five tons of lime dust to the acre. This past fall we got six carloads in August, and one ten days ago.

Sweet clover has found a place of great importance on my farm. So much has been said about it lately that I want to read two letters from neighbors. One lives on a little better land than I own—there is a little more nitrogen in it—and the other one is down in the hill country. This first letter is from William Ziegler, president of the Jackson County Farm Bureau. He says:

What Others Says.

"In reply to your request in regard to my experience in using limestone, I will say I began spreading it in the summer of 1913. At that time I got my first car and covered 6 acres, with about 4 tons to the acre, sowed in alfalfa the first part of September, 1913. Have cut four crops of hay from the 6 acres every year since, with the exception of last year, when I cut only three crops, and then used the field for pasture. Have made as much as 30 tons of hay from the four cuttings in one season. The field is still in fine condition for further use for hay.

"The balance of that car of lime I spread on some land that I wanted to sow in clover, about 2 tons to the acre. The following spring I sowed the field in clover. Part had an application of lime, part none, but there was much difference in the stand of clover. The part that had lime was far better than the part that had no lime. The following season I got another car of lime, spread most of it on ground that was in pasture 25 years, about 2½ tons per acre, leaving a small square without lime, and sowed the field to sweet clover in August. The sweet clover came up fine all over the field, where there was no lime the sweet clover soon perished. After the above described experience I have used more lime, and now am a strong believer in lime—in fact, I think lime is the only salvation for most of the land in southern Illinois."

The second letter I want to read is from J. C. B. Heaton, of Johnson county. He says:

"You asked me to give my experience with lime dust. I can only touch the edge in one letter and if given in full it would sound too much like the Arabian Nights tales for any but the initiated to believe.

"Before we knew anything of ground limestone, we used a few cars of air slacked lime; when Dr. Hopkins told us that ground limestone was better, we turned to that, and have used 35 or 40 cars. We would not try to farm without limestone. Up until about 1906 or 1907 I worried along trying to keep my indebtedness in bounds, but seeing I could not do so and buy the limestone I needed I plastered my farm with a mortgage, took the money and covered the land with limestone and very soon raised the mortgage and strengthened my credit so much that I could get what money I needed without a mortgage. But this was not accomplished with limestone alone. About the time that I mortgaged my farm I learned of the value of sweet clover as a land renovator and commenced growing it. I soon learned that it would not grow on most of our hills without limestone. So I bought more limestone and followed with sweet clover. Limestone alone will do a wonderful amount of good on most any of our soil, but to do its best it must have a helpmate and that is sweet clover.

"These two, limestone and sweet clover, when intelligently harnessed up together, make a team that will in a few short years pull the poorest of our Southern Illinois farms from under a heavy mortgage and the farmer from poverty to affluence. This is no dream of a visionary, and has been done again and again without a single failure. The half has never yet been told of the value of limestone and sweet clover to Southern Illinois farms. Any farmer can well afford to mortgage his farm to the limit if he will use the money to buy limestone and sweet clover seed, and use them intelligently. An investment of this kind is the only absolutely sure thing I know of."

PRACTICAL POINTS ABOUT PHOSPHATE.

(Ralph Allen.)

The analysis of our Tazewell county soil shows a little less than 1,200 pounds of phosphorus to the acre. To be exact, my ground contains 1,180 pounds to the acre. Now, the standard for good farming land to produce maximum crops is generally conceded to be 2,000 pounds to the acre. So you see our farm is about 40 per cent short of what we ought to have. We have about 60 per cent, which is not enough to raise maximum crops, and my recollection of the crops for a good many years has been that the crops of Tazewell county have been yielding just about 60 per cent of the maximum. A 50-bushel crop of corn is considered a very good crop. Farmers don't complain when they get that, and about that or a little less of oats is a satisfactory crop, and 24 or 25 bushels of wheat is considered a paying crop. If they get less than these yields they begin to grumble, and if they get more they begin to brag.

I have been putting phosphate on my land because I saw that being 40 per cent short, it was the thing that I needed to bring my land up to make it pay better. By the way, during the last four years I have been reading the papers pretty closely and I have dropped into the habit of making fourteen points for everything, the same as the President did.

Bigger Yields, Better Quality, Earlier Maturity.

The first is the matter of yield. Now, I have been practicing this phosphate business for about ten years, and my yields of corn have been excellent, but as most of it has been fed to livestock and not weighed I cannot give definite figures. The oats have been yielding from 50 to 80 and 90 bushels to the acre. Wheat has been averaging about 40 bushels to the acre.

The second point is the matter of quality. I have been getting a better quality of grain. I notice it particularly in the wheat. Under the old method of growing wheat it was not very often that a carload of wheat would grade number one. One year I shipped a carload of wheat to Chicago which graded No. 1. I was a little surprised at that, because I didn't know what the quality of the wheat was. Since then I have tested the wheat as it came from the threshing machine, and when it was hauled into the elevator I had the elevator man test it for weight, and it has tested around 64 pounds to the bushel. It invariably weighs above wheat that is grown on untreated land.

My next point is the matter of early maturity. The grain that is grown on land that contains an abundance of phosphorus, or rather an increased supply over the limited amount that we have, I notice ripens earlier. The wheat grown on treated land will begin to head out from a half a day to a day and a half earlier than the wheat grown on untreated land, and the binders will start earlier on fields that have been treated than on the others. There is some advantage in that, but not very much. But I want to speak of early maturity in corn as well as in wheat. You know that there is a great complaint about our corn not getting ripe. I have noticed that the corn on treated land matures earlier. It is planted the same time, but it matures earlier in the fall, and we get a better quality. In fact, I have had very little trouble in securing seed corn since I have been treating my land with phosphate.

Now, the fourth point is the matter of insect attack. It was a matter of surprise to me to find that the grain grown on treated land would withstand insects better than the grain grown on untreated land. I first noticed it when I had a check plot running through my field of wheat, and in that check plot the wheat was badly infested with the Hessian fly, and on either side of it the depredations of the fly were not nearly so serious. I have noticed that the fly does not injure the wheat nearly as much on treated land as it does on untreated land. My only explanation of that is that with plenty of plant food the wheat can heal the wound that the fly makes as fast as the fly can make it, and so it can outgrow the attack and make a crop in spite of the fly.

My fifth point is the matter of winter killing of wheat. I have found that wheat on treated land will go through the winter when wheat on untreated land will die. The only explanation that I can make of that is, that it has plenty to live on, just the same as cattle that live out of doors, if they have plenty of food they can withstand the bad storms of winter, whereas those that are insufficiently supplied with food grow thinner and thinner, and a good many of them are winter killed.

Gives Permanent Improvement.

The sixth point is, that the treatment of soil with phosphate is a permanent improvement. It isn't an improvement from year to year, it is an improvement that lasts. I have been asked a good many times, how long a ton of phosphate will last. Roughly figuring, it will last long enough to take a thousand bushels of corn off of the ground before the land is as poor in phosphorus as before the application was made. In my own farming I figure that an application of a ton of phosphorus in a six-year rotation I am not taking out over 25 per cent of the phosphorus that I have put in during that time, so I have 75 per cent of it left. Of course, there is nothing that lasts forever. The buildings that you put on the farm do not last forever, you have got to maintain them, and when you have your land built up to the 2,000-pound standard, or near that, of course, you have to maintain it with the amount equivalent to that which you take out of it. It is just the same as with the building, you have to paint it and have it shingled once in a while.

The seventh point is the matter of cost. I can say that it is a self-paying proposition, it pays for itself as it goes along. In order to build up your land to the 2,000-pound standard, if the phosphate costs $6.50 a ton, or a little over, you don't have to make an outlay of $20 an acre to get three tons on. I would never do that. It pays for itself year by year as it goes along, it brings that investment back again immediately, so that you are constantly using the same money instead of new money when you improve your farm. If you put tile in you have to buy new tile, but your drained land would pay for the new tile. So it is with the phosphate, the increased yield and the increased profits make it a self-paying proposition, so if you once start all you have to do is to keep going and the thing will pay for itself as it goes along.

Now, the eighth point. You have all received bulletins from the experiment station and some of you may think that college men can do certain things that you cannot do. My experience has been that it works out just the same on farms as it does on the experiment stations.

The next point is the ninth. You will notice that the yields of wheat on the brown silt loam located at Urbana, Ford county and Bloomington, the yields on the well treated plots are running about

40 bushels to the acre. I told you in the beginning that my yields of wheat were running along just about 40 bushels to the acre, so I have been getting practically the same results as the experiment station.

The tenth points is along the same line, and that is the difference between the well treated plot and the check plot. I told you in the beginning that in our county a satisfactory wheat crop is around 25 bushels to the acre, and that I am getting 40 bushels. In fact, I am getting a little more than 40 bushels per acre. I am getting just about 16 bushels above the satisfactory crop, and if you will examine the reports of the experiment station you will find that the difference between those fields which are well treated with phosphate and those that receive no treatment runs just about the same, about 16 bushels to the acre.

Another thing, and one of the best things that I have noticed in connection with this and in comparison with the university work,—and this is my eleventh point,—that as the work goes on year after year the crops increase. I have seen experiment fields in different parts of the State that seemed almost hopeless, but when Dr. Hopkins would take charge of them the yields got better and the crops became surer, there was a less chance of failure, and I am finding that out on my own farm. I have been once around with a ton application on my farm, and have started around the second time, and the result is I am getting better crops than I had the first time around.

Phosphorus Helps to Save Clover.

Now, my twelfth point is clover. A good deal has been said about clover this morning, and I can say the same things. We not only get better yields, but we get better chances for a stand of clover with the application of phosphorus, and it gives us a better chance to maintain our rotation of crops. You know, those of you who live on that type of soil, how many times you have in the past failed to get a stand of clover, and that would simply break up our whole system of rotation.

Now the thirteenth point: I want to call your attention to a line of soil treatment that is very seldom spoken of, and that is the effect on grass land. I hesitated to put phosphorus on grass land for a while, I thought maybe I would not get my money back, but I tried it by giving the land a ton application. That forty acres has been in our family since 1867, it was in the original home farm, and I have known the field ever since I was a boy, and I knew the crops. It has been seeded down several times during these over fifty years, but we have never in that time raised such crops of grass as now. The greatest yields have been since this application, and now it is going into permanent pasture, and it is carrying stock better than any other piece of land that I have in permanent pasture.

For a fourteenth point I will simply call it the satisfaction that a man gets by doing a good thing. Some people might make a long sermon on that; I will just speak of the good a man does when he raised an extra bushel of grain where it would not grow before. Think of the full stomachs that we are going to have over on the other side, which are so empty and gnawing at the present time, and think how patriotic we are and how the full stomach is going to down the Bolsheviki.

LIMESTONE FOR LEGUMES.

(W. E. Riegel.)

One of the main things derived from limestone is that after a man has used it for a number of years it develops a very sweet disposition. I think we are not likely, especially in the central part of the state, to emphasize the importance of limestone quite enough especially on farms where they are growing a lot of legumes.

We are interested very directly in the use of limestone to produce bigger crops for livestock, as practically all of our legumes and practically all of our corn are harvested with livestock. On the lighter phase of brown silt loam, and even on some of the better phase of brown silt loam, these legumes will do much better if we put on an application of limestone.

We have had two applications of rock phosphate, and now we see that by applying limestone we get a very much better growth of clovers and various legumes. We find that soy beans and cowpeas do not do so much better after the application of limestone as does some of the clover. Alsike grows very well in many instances without the application of limestone. Red clover is helped a great deal by the use of limestone; alfalfa is also greatly helped, and especially sweet clover.

We are using a mixture in our pasture crop of sweet clover, red clover, alsake and timothy, and it is very interesting to watch the field grow. When we get into the heavy phases of silt on clay loam, or heavy phases of brown silt loam the sweet clover makes a heavy growth. When we get to the lighter phases of this field sweet clover doesn't do very good, but by an application of limestone, say two tons to the acre, the lighter phases of soil on this field will produce three or four times as much sweet clover as is produced on the better type of soil on the same field.

People in the central part of the State are not emphasizing enough the use of limestone for growing legumes. You can have soy beans growing in the corn, and clover growing in the wheat, so each year you have legumes growing in your fields. I am sorry to say that we have not used as much limestone as we ought to, but we have come to the point now that we feel if we are going to increase our efficiency in producing legumes, especially the sweet clover and the alfalfa, we must begin now and use considerable limestone.

In using this pasture mixture we want to produce enough clovers, enough timothy and so forth, in this mixture on an acre of land to carry a maximum amount of livestock. In other words, we want to increase the carrying capacity of our pasture. This mixture that I have spoken of increased yields 50 per cent, or more, over red clover or blue grass, but we cannot get this sweet clover to grow as well as it should without the use of limestone. Let me give you an illustration:

In one field last year of 76 acres, we were pasturing 800 to 900 hogs. The east end of this field was of a very light phase of brown silt loam, and we put on an application of two tons of limestone. The whole field had had a ton of rock phosphate. The other end of the field was a pretty good phase of brown silt loam. It was all seeded alike, but the application of limestone increased the carrying capacity by increasing the yield of sweet clover more than 50 per cent. In other words, where we quit putting on limestone there was no sweet clover to speak of, but when we added limestone we had a splendid growth of sweet clover, therefore a splendid pasture, and we were able to carry 50 per cent more livestock than on the better land.

If we apply the limestone and increase our clovers we can put on more stock, and we will be able to produce more meat.

LIMESTONE INSURES ALFALFA.

(Charles McKinley.)

Some years ago I started in with lime rock and have tried to get started with permanent soil fertility methods, and have succeeded pretty nicely. I have a farm of 160 acres in Randolph county and have covered 80 acres of it with three tons per acre, but I have had better results with 10 tons per acre. I have not left any check strips through my field, although I think that is a good plan, but I don't like to see those strips of tickle grass.

I feel that lime is the word "go" to the farmer, the same as in a horse race. You know in a horse race they will all line up at the wire until some fellow is dissatisfied and swings back, then they will all swing back, but when the referee or starter says "go" the fellow who doesn't start will never reach up for the purse.

With the advice of the University and such men as Professor Mosier, Frank I. Mann and our county adviser, J. J. Doerschuk, I have been trying to build up my farm. Now, my land is quite a bit too thin, and I worried quite a bit about whether it would pay to lime the soil or not, and when I started in permanent soil fertility I thought of these words:

Lime, lime without manure,
Makes both farm and farmer poor.
Lime, rock phosphate and sweet clover,
Makes the old farm rich all over.

I commenced to lime my best land first, which brought me in quicker income. I picked out a rich field and limed that and sowed it in alfalfa in 1912. Then I commenced to look around for cows. My plan was to separate the milk and feed it on the farm and sell the cream, and by doing that I was able to realize quite a bit more profit than I really expected. It actually put me in the income tax class.

Then I had another crop to help along, which was sweet clover. I harvested $600 or more of sweet clover seed this year from 10 acres, and that also added to my income.

I have a twelve and a half acre field which was all limed in 1914. A part of it was sowed in alfalfa, and the rest of the field in red clover and sweet clover. The sweet clover did nicely on that soil, and the red clover did exceptionally well, but the ground was so flat that it did not drain off, and consequently I didn't have any alfalfa on that type of soil. That fall I gave it an application of phosphate, an even application all over the field, and I threshed the sweet clover crop and put back the residues, plowed the red clover under with the alfalfa, and then put in wheat.

That was a good wheat year in southern Illinois. The wheat averaged 29 bushels per acre, and it tested 63 pounds in the brass bucket and took the premium at the Sparta Fair. Then it was all sowed in sweet clover and red clover, and last year I harvested the sweet clover, which grew on the land where the alfalfa had failed. Then I put on another application of phosphate, the sweet clover residue and red clover were plowed under, and a thin application of lime put on. I sowed it to wheat again, and seeded it all in sweet clover. I don't expect to see any more red clover.

Lime has done a wonderful thing when it started the good crops that it did on that thin land. Lime has made it possible for almost every farmer in Randolph county to have a nice field of alfalfa to feed cattle, and lime has made it possible for every farmer in Randolph county to have a field of sweet clover to feed the wheat, corn and oats.

Lime has made it possible for me to quit robbing the soil, which is a great satisfaction to me. Lime rock will do wonderful things when the crop is adapted to the soil. My brother has a piece of land which we call good land. He limed it four years ago and sowed it in alfalfa, and he has cut from $100 to $160 worth of hay every year since, which is double the price he could have realized from other crops in a rotation, if he had not limed the land.

PHOSPHATE ROCK BEST FARM INVESTMENT.

(J. C. Mies.)

Phosphate with me, means clover, and while I say that phosphate is the keynote of the situation, the clover is the salvation, after all, of our soil. We must have clover. Without clover we are unable to build up our land. When I first moved on to my farm in 1906 I was unable to raise clover. Usually I failed, and when I did get my clover it was probably a ton to a ton and a half an acre. Since I have made my first application of phosphate on the land,—1912 was when I really started,—I have never failed in getting a good stand of clover, and now, instead of raising a ton to a ton and a half an acre, I raise as high as four and five tons to the acre. One time I put in Mammoth clover, and I had Mammoth clover over six feet, two inches long. This to me is the secret of soil building.

Phosphate has given me this stand of clover, it practically insures me a stand of clover when I sow it, it gives me more organic matter to plow under, and, consequently, I can reduce my oats crop. and by spring plowing stalk ground for corn, and I do not have the trouble with the spring plowing becoming cloddy. If I have more organic matter in the soil my land is more fit for plowing, it is in a better physical condition. Furthermore, it has been a great lesson to me, and when my boys have grown up I can already see that they will be more interested in farming than a lot of other boys where the crops are simply normal.

The results which I will give are mostly from one ton of rock phosphate per acre, although I have an application of two tons per acre on the 400-acre farm. In the last two years I have put on 400 tons, probably as much, if not more than any one single individual in the state on that size farm. I covered the entire farm in two years' time, and I expect to do the same thing in the next two years. In fact, I have already four carloads ordered for this coming year, which will be enough to cover half of it.

What Crop Yields Show.

Of course, we are all interested in the increase of crops. That, with me, is not so much the first consideration, as is the good that I can do by having my farm as an object lesson, and probably persuading my boys to stay with me on the farm, and later on take charge of it.

Corn Yields Before Using Phosphate.

Year.	Acres.	Bushels.	Average per acre.
1906.............	150	6,350	42.3
1907.............	120	4,652	38.7
1908.............	84	2,740	32.7
1909.............	134	5,410	40.3
1910.............	114	4,560	40.0
1911.............	114	4,140	36.3
Total........	716	27,852	38.9

Corn Yields After Using Phosphate.

Year.	Acres.	Bushels.	Average per acre.
1915.............	122	6,700	55.0
1916.............	122	6,100	50.0
1917.............	92	5,800	63.0
1918.............	165	9,075	55.0
Total........	501	27,675	55.2

Average Increase from Phosphate--16.3 bushels per acre.

Sixty acres of corn on an adjoining eighty without phosphate yielded 45 bushels per acre, while 92 acres with phosphate yielded 63 bushels per acre. A comparison of these tables shows an advantage of 16.3 bushels per acre in favor of phosphate. Crops for 1912, 1913 and 1914 are discarded because only parts of the fields were phosphated.

My crops from 1906 to 1911, inclusive, with a total of 716 acres in corn, averaged 39 bushels per acre, and the highest in any one year was 42 bushels, and the lowest was 33 bushels. In the same period, the oat crops, 531 acres, averaged 31½ bushels, the highest being 40 bushels and the lowest 25 bushels. The wheat crop, from 1907 to 1911, 235 acres, averaged 21⅜ bushels per acre, the highest being 27 bushels and the lowest 17 bushels.

Now, if you will stop a minute and average the 39 bushels of corn for six years, and the 31½ bushels of oats for six years, and the average of 21⅜ bushels of wheat for five years at the prices we then had, and you can readily see it was not very encouraging.

The crops for the past four years, 1915 to 1918, inclusive, were as follows: 501 acres of corn averaging 55 bushels to the acre, the highest being 71½ bushels and the lowest 50 bushels. During this period, 262 acres of oats averaged 56 bushels per acre, the highest being 76 and the lowest 45 bushels. This year was a very poor oats year, averaging 45 bushels to the acre. The wheat, 330 acres, averaged 31¼ bushels per acre, the highest being 38 bushels and the lowest 24. In 1916 you will remember we had a very poor year for wheat. In 1916-1917 we had a very hard winter, and a large part of the wheat was plowed up in our territory. I left mine and harvested an average of 26½ bushels per acre. Those are my figures for the entire acreage on the large farm.

Here are some figures on my work beginning with phosphate, and with only one ton to the acre: I sowed 10 acres in oats, and I had 45 bushels to the acre, and on the rest of the farm I had 30 bushels, a difference of 15 bushels in favor of the phosphate. That was in 1910. Now, in 1912, I had 10 acres in oats and I had 78 bushels to the acre, and I had 60 acres with an average of 53 bushels to the acre, or a difference of 25 bushels per acre in favor of the phosphate. In 1914 I had 46 acres averaging 47 bushels for phosphate, and on 64 acres, the balance of the farm (these fields are all handled alike, with the

Wheat Yields Before Using Phosphate.

Year.	Acres.	Bushels.	Average per acre.
1907	40	1,080	27.0
1908	80	1,680	21.0
1909	36	612	17.0
1910	43	1,075	25.0
1911	40	760	19.0
Total	239	5,207	21.8

Wheat Yields After Using Phosphate.

Year.	Acres.	Bushels.	Average per acre.
1915	136	4,692	34.5
1916	64	1,536	24.0
1917	60	1,590	26.5
1918	70	2,660	38.0
Total	330	10,478	31.75

Average Increase for Phosphate—9.5 bushels per acre.

same kind of seed), I had 38 bushels, or a difference of 9 bushels that year in favor of phosphate in the ground.

Now the corn crop in 1911: ten acres of corn with phosphate, 40 bushels to the acre; 104 acres without phosphate, 35 bushels, or a difference of 5 bushels. In 1912, 36 acres with phosphate, 71½ bushels to the acre, and 120 acres without phosphate, 53½ bushels of corn, a difference of 18 bushels. In 1913, on this same 36 acres with phosphate, 47 bushels of corn; 65 acres without phosphate, 41 bushels of corn, a difference of 6 bushels.

As I said, when I first started out, this was mostly done with one ton of phosphate per acre, the other figures were with a two-ton application. A large amount was applied in the spring of 1918, and the balance of this last application in the fall of 1917, so it is not in working order and I haven't had time for many results. I have another set of figures on this first treatment which shows the different methods of computation and my results on the farm.

This 36 acres is the first part I treated. On it, in 1912, I had

Oat Yields Before Using Phosphate.

Year.	Acres.	Bushels.	Average per acre.
1906.............	134	4,426	33.0
1907.............	105	2,715	25.9
1908.............	60	1,500	25.0
1909.............	84	3,360	40.0
1910.............	84	2,520	30.0
1911.............	64	2,240	35.0
Total........	531	16,761	31.6

Oat Yields After Using Phosphate.

Year.	Acres	Bushels.	Average per acre.
1915.............	25	1,900	76.0
1916.............	57	2,850	57.0
1917.............	100	6,300	63.0
1918.............	80	3,600	45.0
Total........	262	14,650	56.0

Average Increase from Phosphate—24.4 bushels per acre.

In this table 60 acres of oats were included on an adjoining 80 acres This had been phosphated, but no clover or organic matter had been added to make it available and the results in 1918 are hardly fair to phosphate on account of this condition which did not apply on the land in oats the other years. A comparison of these tables shows an advantage of 24.4 bushels per acre of oats for phosphate.

71½ bushels of corn, and on the adjoining 20 acres that had not been treated I had 50 bushels of corn. Also note that I had an average of 53 bushels on the entire farm. This adjoining field happened to be the same kind of land, and it made 50 bushels the next year.

The gross income from the 36 acres was $115, and the gross income from the adjoining 20 acres was $86, making a difference of $29 to be credited to phosphate. The cost of that application,—I only put on 1,300 pounds, because I didn't have quite nerve enough to go as high as a ton, I was experimenting,—was $6.00 an acre, and there is a large percent of this phosphate left in the ground.

Here is another set of figures on this 36 acres, from 1912 to 1919, inclusive. This 36 acres averaged 8 per cent on a valuation of $312 an acre. This was at pre-war prices, the highest priced corn I sold was 78 cents, and yet my net income as near as I can figure it was 8 per cent on the valuation of $313 an acre. This was done on brown silt loam in Livingston county.

I have used enough limestone to know that limestone is all right, but rock phosphate is so much more profitable that I would advise in our territory the use of phosphorus first, because phosphorus will do for us just exactly what limestone will do in the southern part of the State. It will insure a clover crop, and instead of raising 1½ tons per acre we can and do raise 4 or 5 tons per acre.

LIME AND PHOSPHATE RESULTS.

(C. C. Logan.)

Most progressive farmers recognize that not only limestone but also rock phosphate is needed on Crawford county soils to insure the best crop yields, and for this reason a majority of the following experiences relate to rock phosphate as well as to limestone.

In order to cite concrete examples of results in this line of work, the writer has interviewed a few experienced men on this subject and the following experiences are related as far as possible in the language of those interviewed.

Big Gains in Crop Yields.

In 1917 Sylvester Crozier, of Honey Creek township, applied one and one-half tons of rock phosphate to one acre of blue grass sod and plowed it under in April. After disking and dragging a number of times, a total of eight tons of limestone was put on in two applications during the summer. In July, another ton of rock phosphate was applied and disked in, and on the 26th of the same month, following a little rain, the seed bed was prepared, the seed sown and the soil was inoculated with sweet clover soil. In the spring of 1918 the alfalfa started off in fine shape and on the 4th day of May it was cut for the first time. On the 3rd of June, the stalks were from 24 to 26 inches in height and it was cut the second time. The third cutting was made on July 10, and the fourth on August 15th. On September 20th, a full crop was ready to cut again, but instead of cutting, it was pastured. As near as can be estimated, the total yield, exclusive of the pasturage on the one acre, was five and one-half tons of field-cured alfalfa hay. This test was made on yellow gray silt loam.

Mr. Smith Kirk, of Oblong township, relates the following experience: "Five years ago I used limestone on ten acres of meadow land, using four tons per acre. The first year, I cut one ton of hay per acre, all timothy. The next year, one and one-half tons of timothy and a little clover. For the last three years, I have cut two tons per acre, about two-thirds of which was clover. This is old prairie land and has been farmed for 60 years."

Mr. Z. J. Cawood, Secretary of the Palestine Township High School Board, furnished me the following information: "The acre of alfalfa on the school ground was sowed in September, 1912. The only addition to the soil in the way of treatment was two tons of limestone and inoculation at the time of seeding. Seven and one-half (7½) tons of hay were cut from this acre in 1917. Have been offered $36 cash rent for the one acre for this season." This was on yellow gray sandy loam.

On interviewing S. D. Newlin of Hutsonville, the following experience was related: "I reckon it was 11 years ago, I commenced using limestone. I have put limestone on 455 acres of Crawford county land and have applied rock phosphate on 455 acres, I think."

When asked for concrete results, Mr. Newlin said: "No, I have no actual figures to give, but I am thoroughly convinced that it has paid, or else I would not be going ahead with it. After treating 60 acres with both limestone and phosphate, except a small corner stack lot, it was all seeded to mixed clover and timothy and this last year there was a thick uniform stand of clover and timothy all over, except on the corner stack lot, where the clover was very scattering. It was very plain to see exactly where the limestone had been applied. Even where rock phosphate had been used, but not limestone, there was no clover. The phosphorus feeds the clover and yet it does but little good unless the soil has first had limestone. Only about two tons of limestone had been used per acre in these tests and now the first land treated is beginning to show a need of more. This limestone has been used on typical prairie soil which has several 'moon shine spots' in it."

Mr. Webster Tuttle and son, of West York, used about three-fourths tons of rock phosphate per acre on six acres in 1916, and grew corn. In 1917, a total of six tons per acre of limestone was applied in two applications and was thoroughly worked into the soil by disking and dragging several times during the summer. A part of the plot was seeded to alfalfa with barley in March, 1917, and the remainder seeded to alfalfa by itself in August of the same year. Three cuttings were made in 1918, giving a total estimated yield of 4 tons per acre of field-cured hay, besides furnishing a large amount of pasturage for sheep and hogs in the fall of 1918. Mr. Tuttle likes the idea of seeding alfalfa with a nurse crop of barley. He sows from one-half bushel to three pecks per acre of beardless barley.

The following is from Ed. Lindley, Hutsonville, Ill.:

"In 1916, 106 tons of limestone were used on a little less than 40 acres in Hutsonville township. Thirteen acres of this was sowed to oats in March, the remainder was sowed to cow peas in June. After cutting the oats, 23½ tons of rock phosphate were used on the 40 acres; that is, on both the peas and on the oats stubble. In August the peas and oats stubble was all plowed under and the entire field was sowed to wheat in October. Counting the field 40 acres, the average yield of wheat per acre was 42 bushels, or to be exact, a total of 1,670 bushels. A 20-acre field of untreated land nearby made 27 bushels per acre, but the 40 acres mentioned above would not have done better, I think, than 25 bushels. To be conservative, therefore, the increase due to limestone and rock phosphate and the organic matter plowed under was 17 bushels per acre."

Yields Tell the Story.

In the fall of 1913, Mr. Virgil Walker, of Lanroth township, applied one ton of rock phosphate and about ten loads of manure per acre on a plot of eight acres and plowed it under. Following this, four tons of limestone per acre were applied, and thoroughly worked into the ground by disking and dragging. On September 15th, the alfalfa was seeded and about ten loads of manure per acre were added during the fall. The season was very dry but a good rain came soon after seeding. Two crops were cut in 1914 and three each in 1915 and 1916, and it was pastured each fall, but no records were kept. In 1917 it was cut three times and the fourth crop was pastured off.

The total yield in 1917 from eight acres was 51 tons. Three cuttings were made in 1918, the fourth crop being pastured down. The total yield of field-cured hay from the eight acres was 56 tons in 1918.

Mr. Walker did not have much faith in rock phosphate at first, but in view of the fact that the yield of alfalfa hay holds up, or even increases from year to year, he now feels certain that phosphorus is beneficial and he will hereafter always use it. Mr. Walker is using rock phosphate in his cow stables now, so that wherever manure is used he will also have the phosphorus, and the only additional treatment required, therefore, will be limestone. He is now producing feed on one small tract of 35 acres sufficient for 35 head of stock, and is starting alfalfa on another farm. He hesitates to tell men of the results obtained for it doesn't sound reasonable, yet it is true. The soil on which this test was made is of the brown sandy loam type and represents quite an area in the section around Palestine. A neighbor of Mr. Walker's has sown alfalfa three times on an adjacent plot of ground, of the same type, but has never succeeded as yet in getting a stand. In other words, limestone and rock phosphate together with a little manure has spelled success in Mr. Walker's experience and the absence of these materials has certainly resulted in a failure for his neighbor.

First Crop of Alfalfa on tile-drained prairie land—Alfalfa which had been well Limed.

P. J. Garrard, of Robinson township, has grown some alfalfa on flat tile-drained prairie land, underlaid by tight clay. A narrow strip about 10 to 12 feet wide directly over the tile has done much better than that some distance back from the tile.

A host of other experiences might be related if time permitted, but only one additional evidence of the value of limestone will be cited. A part of Crawford county lies in the oil belt and in practically all cases in drilling for oil a stratum of limestone is passed through at some distance below the surface. When these so-called "sand pumpings" are left on the surface, they frequently become covered with enormous growth of leguminous plants such as red alsike or sweet clover. In one instance, a plot of 13 acres north of Oblong was seeded to sweet clover five years ago, but no sweet clover grew except on a small plot which has been covered each year for the past five years with a mammoth growth of sweet clover.

In this connection, it is well to keep in mind that no organic manures have ever been applied to these "sand pumpings" and that this growth of sweet clover is undoubtedly due to the limestone which is evident in this new-made soil and to the mineral plant food which it contains.

IMPROVES FARM WITH PHOSPHATE.

(Wm. Webb.)

In 1915 I had a field that was a mixed clover pasture, composed of clover, alfalfa and a little timothy. I wanted to put that field into corn in 1916 and I knew it was deficient in nitrogren. I had 60 acres of medium red clover in another field, so a part of this field I cut early for hay and also took off a seed crop; on the balance of the ield I took off only the seed crop. On the part of the field where I took off the hay and the seed crop I spread back the clover straw. I had enough clover straw left to go over this field. After spreading the clover straw in the fall of 1915, I cut the field with a sharp disk, then plowed it 6½ inches deep. In 1916 the field was planted to corn. In the fall of 1916 I decided to get the field ready to be sown to alfalfa, in 1917, giving it an application of 2,000 pounds of rock phosphate per acre.

I put in a good deal of work on that field to get the ground packed down so there would be no air spaces around the stalks, and also between the plowed ground and the sub-soil, so as to have a good, compact, deep seed bed for my alfalfa. Then I went on and drilled t in with a drill with a little less than a bushel of barley seed per acre as a nurse crop, thinking I would cut the barley for hay to get t off early so as to give the alfalfa a better chance, as it was an alfalfa field that I was after. I seeded eleven pounds of scarifie alfalfa seed per acre. Then I rolled the field twice.

When the barley was headed nicely I went over the field to se if it was ready to cut for hay and I found there was a beautiful stan of alfalfa, full ten inches high, a nice green color. The alfalfa looke so good and the barley was heading out so nicely that I decided t let it stand and cut it for seed. That barley made a little better tha 70 bushels per acre. It netted me over $100 dollars an acre. Th last year I had better than 6 tons of alfalfa to the acre from th field, the finest alfalfa that I ever had in the barn. We are feedir it to our horses, our colts, our cattle, our chickens, and I use it fc tooth picks myself.

Crop Yields Which Count.

Quite a number of years ago I was applying rock phosphate ar I left a part of the field without an application. I wanted to kno for sure whether rock phosphate was paying for itself or not. At th time I didn't know as much about rock phosphate as I do now, ar I don't know as much now as I would like to know. Since that tin I have worked that field and rotated it, so I have had on it a legun crop at least once every three years. Every year since the grain cr on the part of the field that had the application of rock phosphate h matured earlier, made sounder grain and a larger yield. In 1917 I we over that entire field and gave it 2,000 pounds of rock phosphate p acre. This last year I had that field in corn, and it made a large yiel The part of the field that had the second application of rock phospha made from 5 to 7 bushels per acre.

Now, in 1916 I had another field that was just opposite the W county experiment field. That field in 1916 was a mixed pasture clover, alfalfa and a little timothy. I plowed that field in the f and gave it an application of 2,000 pounds of rock phosphate per ac and planted it to corn. In 1917 I had a beautiful field of corn. T corn was maturing early and doing nicely, but on the 9th of Septemb we had a frost which killed the corn. The corn on this field, I thi due to the rock phosphate, had matured pretty well, and made go corn. It was a little soft, but it was far better than my other cc where there was no application of rock phosphate. I fed off the cc with hogs and cattle. I turned in 40 head of hogs and left them 32 days; 34 head of steers and left them in 25 days, and then I to them out and turned my brood sows into the field. They were there three or four weeks and they got all the crop that was left, a the ground was in fine shape for the next year. I might say that tl eld netted me on an average of $52 per acre by feeding it in that way.

This last year I had this same field in wheat and barley, part of in wheat and part of it in barley. I prepared the ground with the isk, the disk as sharp as I could get it. It was very mellow ground. he first time over I ran the disk very nearly straight, so as to cut up he stalks as much as possible, then double disked it and followed it ith the drill, seeding two bushels of wheat per acre. Then I finished p the barley field in the same way, sowing a bushel and a half per cre. I seeded with the barley and also with the wheat, about a pound f rape seed per acre for hog feed, and then put on the roller and rolled twice. I harvested 51½ bushels of wheat per acre, and the barley ade a little better than 75 bushels per acre. We are feeding the bar-y to our hogs and cattle. The wheat I sold to my neighbors at home r $2.50 a bushel, which netted me $128.75 per acre. In addition to at I turned 75 hogs into this field, where they ran for three or four eeks, picking up the scatterings, pasturing on the rape, and that made e a gain of several dollars per acre more to be added to the $128.75.

All Crops Benefited

Just across this field, over the fence on the Will county experiment eld, the wheat plots Nos. 4 and 8 this last year, which were treated ith lime and phosphate, made an average yield over and above plots 5 and 10, that were non-treated, of 17 bushels per acre. In 1915, hich was the first year of the application, those plots, 4 and 8, made average gain over and above the non-treated plots of 12½ bushels r acre.

On the corn crop this year, plots 4 and 8, which are treated with ne and phosphorus made an average gain over and above the non-eated plots of 25 bushels per acre. In 1915, the first year of the eatment, those plots made a gain of something over 8 bushels per re.

On the alfalfa plots, the first year after the treatment, plots 4 and nade an average gain over the non-treated plots of 4,000 pounds per re for the three cuttings. The next season those same plots made average gain of 3,000 pounds for the first cutting and the other ttings were very near the same.

On the oats series the yield has not been quite as much for the eatment although the gain has been more than enough to pay for rock phosphate, and lime. The lowest yielding plot on the oat field s year was 69 bushels, and the highest treated plot was 81½ shels per acre. This was a small, early variety. We sowed them last ar thinking we could get a better stand of clover. I am satisfied if those oats had been Big Four or Silver Mine those treated plots would have yielded at least 100 bushels to the acre.

If we keep up this method of farming, and I think Mr. Mann will bear me out in this,—I think it will be only a few years until we will be able to raise 100 bushels of corn, 50 bushels of wheat and 100 bushels of oats per acre.

LIMESTONE, CROP RESIDUES AND LEGUMES.

(Walter Rowe)

Our farm consists of 112 acres. Primarily, we are dairy farmers. We have been using rock phosphate since 1911. We have been growing alfalfa since 1907. We started in to grow alfalfa before we used any rock phosphate, or any limestone. It was rather up-hill work until we began to use rock phosphate and limestone. We found practically n difficulty in getting stands of alfalfa, and we have the alfalfa to fee our cows.

We have a system on our farm, I think Mr. Mann put it int words in this way: "Feed the minerals to the legumes and then fee all of your legumes and all of your crop residues to your grain crops.' That is the system we try to follow out.

We sell very little from our farm except milk and eggs. All o you know that those things do not take very much soil fertility fro the land. When we have an opportunity to buy any straw or clove or anything that will add to the fertility of the soil we put it bac on. We have been over all of our farm with rock phosphate, and w

Silvermine Oats on Farm of Mr. Rowe, yielding 80¾ Bushels per acre—Roc Phosphate applied at Rate of 1,000 pounds per acre.

have started on the second round, covering the farm the second time. We firmly believe in the application of rock phosphate.

We only had 50 bushels of oats as the best possible yield before we used rock phosphate. Our best yield of oats, since we used rock phosphate, was 80.3 per acre on timber soil, and not very good timber soil at that.

I do not attribute all of our success to the limestone, but to a combination of limestone, crop residues and legumes.

We must have approximately one-third of our farms in legumes if we want to maintain our soil fertility. That seems to be rather a drawback to some who are accustomed to raising a lot of corn, but you will have more corn if you have more legumes. It seems it is a good deal like David Harum states, "Them that has, gits." It doesn't seem possible to get more corn by having fewer acres, but it is possible.

So let us keep plenty of legumes, sweet clover, alfalfa, soy beans, or something of that nature, growing on the land and use plenty of minerals and we will be mighty near a solution.

LIMESTONE ASSOCIATIONS HELP.

(A. C. Everingham.)

The fact of the matter is that limestone has absolutely demonstrated itself, I might tell you that on a field that I planted a few years ago, if I had been able to raise a fuss in the field you could not have heard it across the fence. By the use of limestone and phosphate that field will now grow anything that I put in the ground. It seems to me that the crying need for southern Illinois now—and perhaps some other parts of Illinois are interested—is not a question of teaching people to use limestone, but it is a question of getting the limestone when we need it.

It seems to me that the thing that we must work out, if we are going to solve the soil problems of Illinois, is for the user, the producer and the transporter to get together on some sort of a proposition whereby when we order a carload of limestone we shall know we are going to get that carload of limestone at a time when we can put it on the ground.

In Crawford county we feel like we have made a start, so far as we are concerned, in the right direction. Through the Farm Bureau we have leased from the railroad company at every unloading point in the county plots of ground, and we are working out a scheme whereby we shall form limestone associations for the purpose of defraying the expense of building a shed, so that limestone can be hauled in at a time when the plants can produce it, and the farmers can use to advantage, and stored so that the farmers can use it whenever they want it. Now, that will greatly benefit the fellow who has not been in the habits of using limestone in a large way. Sometimes he is five or ten miles from the railroad, but when he goes to market with a wagonload of hogs, or wheat, or something of that kind, there is limestone there and he can get it and haul it home with him. That is not the only one it will benefit, it will benefit the man who uses only a carload of limestone, or more than a carload of limestone at a time, because our experience has been that when you order a carload of limestone to be shipped in September, if you get it in January you are doing mighty well. If we have a place to put it and keep it stored all the time it will be a great help.

A COOPERATIVE ASSOCIATION.

(K. W. Cleland.)

A number of us farmers wanted limestone and phosphate, and the labor proposition was such that we could not handle the car alone as it came, so we decided to see how many of the other neighbors around would like to go in with us and get some on hand. So two of us started out one afternoon to see what we could work out, and the result was we decided to charge a membership fee of $20 each. That is, we estimated about how many we thought we could get into it, and then divided the price of a carload of phosphate and a carload of limestone. That $20 gives working capital for the organization. The members pay cash for the material as they get it, then as the supply goes down the secretary and treasurer has the money ready to order a new supply. We have decided to charge fifty cents a ton extra for limestone and a dollar and a half a ton extra for phosphate to outsiders and allow them to haul only when the supply is ample. For instance in the last month we have had good roads and the amount that we have been able to get on hand wasn't near as much as the members themselves wanted. There were quite a number of outsiders who wanted to get some to try it. That difference was an effective means of getting new members. We secured quite a number of new members by having that clause in our agreement.

The maintaining of the supply, the weighing and keeping books is an essential feature. We have a man in our village, a lumber and coal dealer, who is also a farmer, and he agreed to do this work fo just what he charges for weighing, 10 cents a load. So he keeps the books and weighs the material and orders the new supply as it di minishes, and does all that for 10 cents a ton. We rent one of his coal bins for phosphate and pay him a small rental for that. As soon as we get a little further along, probably this summer, we expect to build sheds and have a more permanent arrangement.

We are located in Boone county. We have started with 40 members and have 50 now.

Another Local Association.

MR. MANN: That is a small local organization which any neighborhood can operate. I am going to tell you about the one in Kankakee County. I wish Mr. Collier the county adviser was here to tell it to you. They are going to establish twelve store houses at twelve different points in Kankakee county. These storehouses are to be built of concrete, and the floor will be so high from the ground that the stuff will shoot into wagons. Then they are calculating to put in machinery to take the material from the car and elevate it into these storehouses. These storehouses are to have a capacity of 5,000 tons of phosphate and 1,500 tons of limestone. They are selling shares at $100 each. In some places they have one hundred shares already sold, and there are to be twelve of them in the one county. Now, don't think they don't know what phosphate is in Kankakee county.

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